Plant community development after nine growing seasons in the two experimental wetland basins

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Introduction

Since 1994, we have been monitoring the plant cover and species richness in the two experimental basins at the Olentangy River Wetland Research Park (ORWRP). In May 1994, Wetland 1 was planted with 2,400 individuals of 13 species of native wetland plants while Wetland 2 was left unplanted as a control (Mitsch et al., 1998). The hypothesis regarding these basins was that "planted and unplanted basins will be similar in function in the beginning, diverge in function during the middle years and ultimately converge in structure and function" (Mitsch et al., 1998).

This paper presents interpretation of aerial photography at the ORWRP taken on August 2, 2002, the end of the ninth growing season for these basins. The previous eight years are summarized by Mitsch and Zhang (2002). The objective was to determine the spatial patterns of plant communities within the two wetlands and to determine changes over previous years.

Methods

A color aerial photograph taken by ODOT on August 2, 2002 was used to outline the wetland areas and the dominant vegetation communities for 2002. The photograph was scanned and imported into ArcView 3.2. A number of polygons were digitized with different plant communities. With spatial analysis in ArcView 3.2, those polygons were exported to raster (gridscale) files to compute percentage of area for each vegetation community.

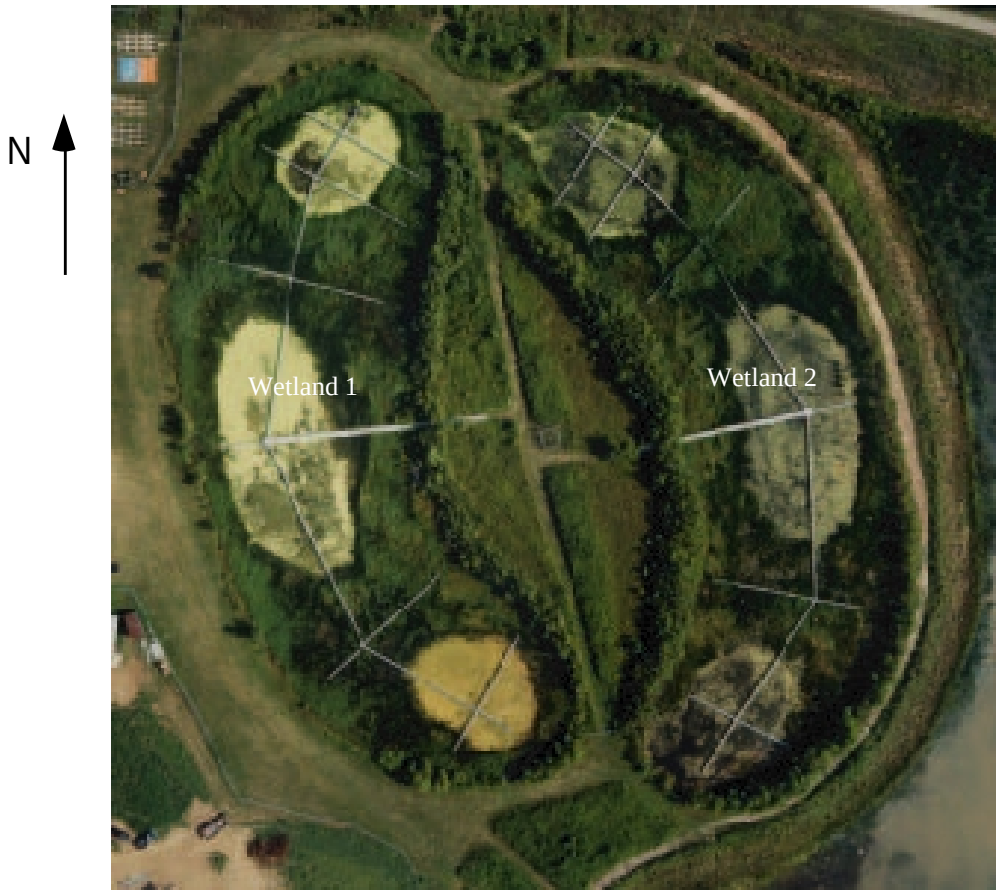

Figure 1. Color aerial photograph in August 2, 2002 of the two experimental wetland basins (Wetland 1 and Wetland 2).

Results and Discussion

Wetland 1 had approximately 73% macrophyte cover and Wetland 2 had an estimated 74% macrophyte cover in August 2002 (Tables 1 and 2; Figures 1 and 2), the highest percent coverage in the basins since the experiment began in 1994. These numbers indicate signicant increases in macrophyte cover in both wetlands after macrophyte cover loss in 2000-2001. This recovery of vegetation can be attributed to two factors: the relative disappearance of herbivores since their wetland "eatout" of 2000-01 (Higgins, 2002) and the low water conditions from a relative drawdown from early April until early July 2002 that allowed significant germination of aquatic plants, particularly *Schoenoplectus tabernaemontani*, from the wetland seed bank. Since 1994, when there was no vegetation cover, coverage had increased yearly in both basins through 1995. Wetland 1 had a greater percent coverage than Wetland 2 until 1997, when that trend reversed. Coverage then decreased in both Wetland 1 and Wetland 2, from 2000 to 2001 as a result of muskrat activity and possibly increased water levels due to outflow swale sedimentation.

Tables 1 and 2 data illustrate that the vegetation communities in the two wetlands essentially converged for the second time in 9 years in 2002. *Schoenoplectus* coverage was essentially complete and dominant in both basins with only a relatively small coverage of *Typha*. This is particularly interesting as *Typha* essentially dominated the unplanted Wetland 2 in the "cattail years" of 1998-2000. The muskrat eatout, followed by spring water level decreases, reset each of the wetlands to *a Schoenoplectus tabernaemontani* sedge marsh in 2002.

Figure 3 presents dominant vegation community patterns from 1994 - 2002. The overall pattern of vegetation can be summarized in three distinct periods of 3 years each.

1. Initial Convergence, 1994-96

Wetland 1 was planted in 1994 and a distinct pattern of vegetation development around the edge of the wetland was observed in 1995 as a result while the "unplanted" wetland remained relatively free of macrophytes except for the edge of cottonwood trees beginning on the interior mudflat. But by the third year, *Schoenoplectus tabernaemontani* had made its way to the unplanted wetland, and by the end of the third growing season, it appeared that the planted and unplanted wetlands had converged with a domination of cover by *Schenoplectus*.

2. Typha Takes Over, 1997-99

Typha dominance increased dramatically in Wetland 2 since1996. It generally has remained less than 17% of the vegetation in Wetland 1. By 1999, Wetland 2 was totally dominated by a very productive cover of *Typha* while Wetland 1 had a diversity of communities including ones dominated by 4 communities: *Sparganium eurycarpum*, *Schoenoplectus tabernaemontani*, *Typha* spp. and *Scirpus fluviatalis*.

3. Wetland Eatout and Resurrection, 2000-2002

Table 1. Coverage (%) in each of the experimental wetlands by each dominant vegetation species in 2002.

Communitiy	W1	W2
Emergent Vegetation Community		
Schoenoplectus tab.	52	63
Sparganium eurycarpum	3	0
Spartina pectinata	1	0
Typha sp	5	9
Polygarum spp.	6	2
Leersia oryzoides	6	0
Total Vegetation	73	74
Open Water	27	26
Total	**100**	**100**

Wetland vegetation began to significantly erode in coverage in 2000, and by 2001, the wetlands had only 27.6% and 17,4% macrophyte coverage in W1 and W2 respectively. The vegetation loss was caused primarily by muskrat activity (Higgins, 2002) and possibly sediment buildup in the outflow swale that caused water to deepen over the years. That is one of the reasons a significant drawdown of both basins was done in spring and early summer 2002-- to allow the seedbank to reset. The approach was successful. At the end of the 2002 growing season, *Typha* coverage was only 9% of the total area of Wetland 2 and 5% of the total area of the originally planted Wetland 1. This was considerably reduced from peak year 1999 when it was 56% of the cover in Wetland 2. One of the most significant changes in 2002 was the increased coverage by *Schoenoplectus tabernaemontani* in both wetlands, apparently from the marsh seedbank. *Schoenoplectus tabernaemontani* (a.k.a. *Scirpus validus*) dominanace increased in both basins in 2002 from 0.3 to 52% coverage in W1 and from 0 to 63% in W2.

The introduced *Spartina pectinata* accounted for 1% of the cover in Wetland 1 in 2002 and was found in the shallow water on the west mudflat. It has never colonized in Wetland 2. It did not appear in the database as a distinct community until 1999; this plant has persisted in small patches since the planting on the edge of the wetland. *Sparganium eurycarpum* has been a major community in Wetland 1 since 1997. It decreased to 3% of the total coverage of Wetland 1 in 2002 after comprising 22% of the total area in 2001 and 16% of the cover in 2000. *Sparganium eurycarpum* has never occurred in Wetland 2.

Another significant change in 2002 was the increased coverage by three species of *Polygonum spp.* (P. *pensylvanicum*, *P. persicaria* and *P. lapathifolium*) in both wetlands, with 6% in W1 and 2% in W2. Cutgrass *Leersia oryzoides* also became dominant in some locations and was considered so with 6% coverage in wetland 1. It also began growing as a co-dominant with *Schenoplectus*.

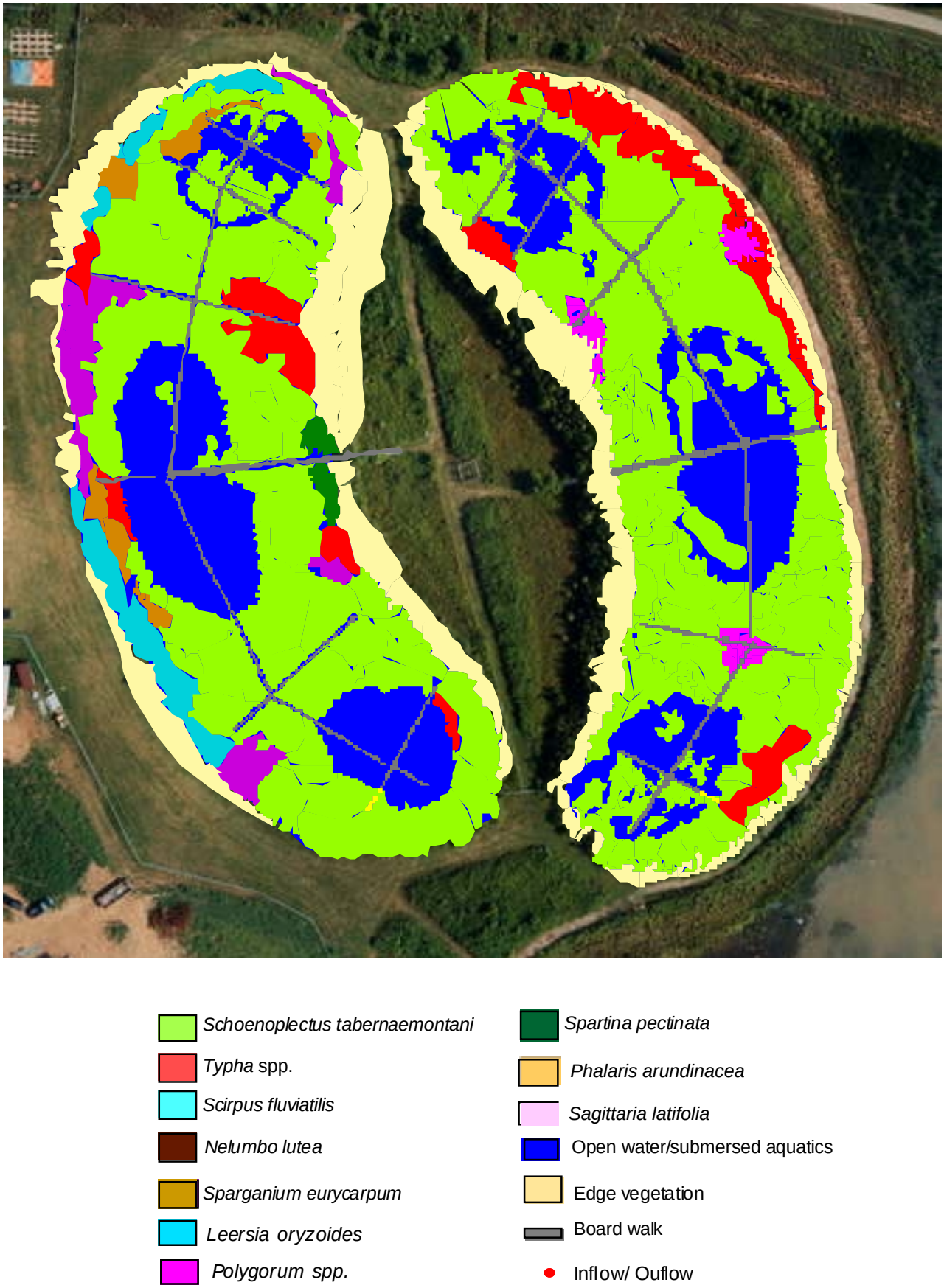

Figure 2. Map of each experimental wetland from August 2002 aerial photograph indicating the areas of dominant vegetation communities and open water.

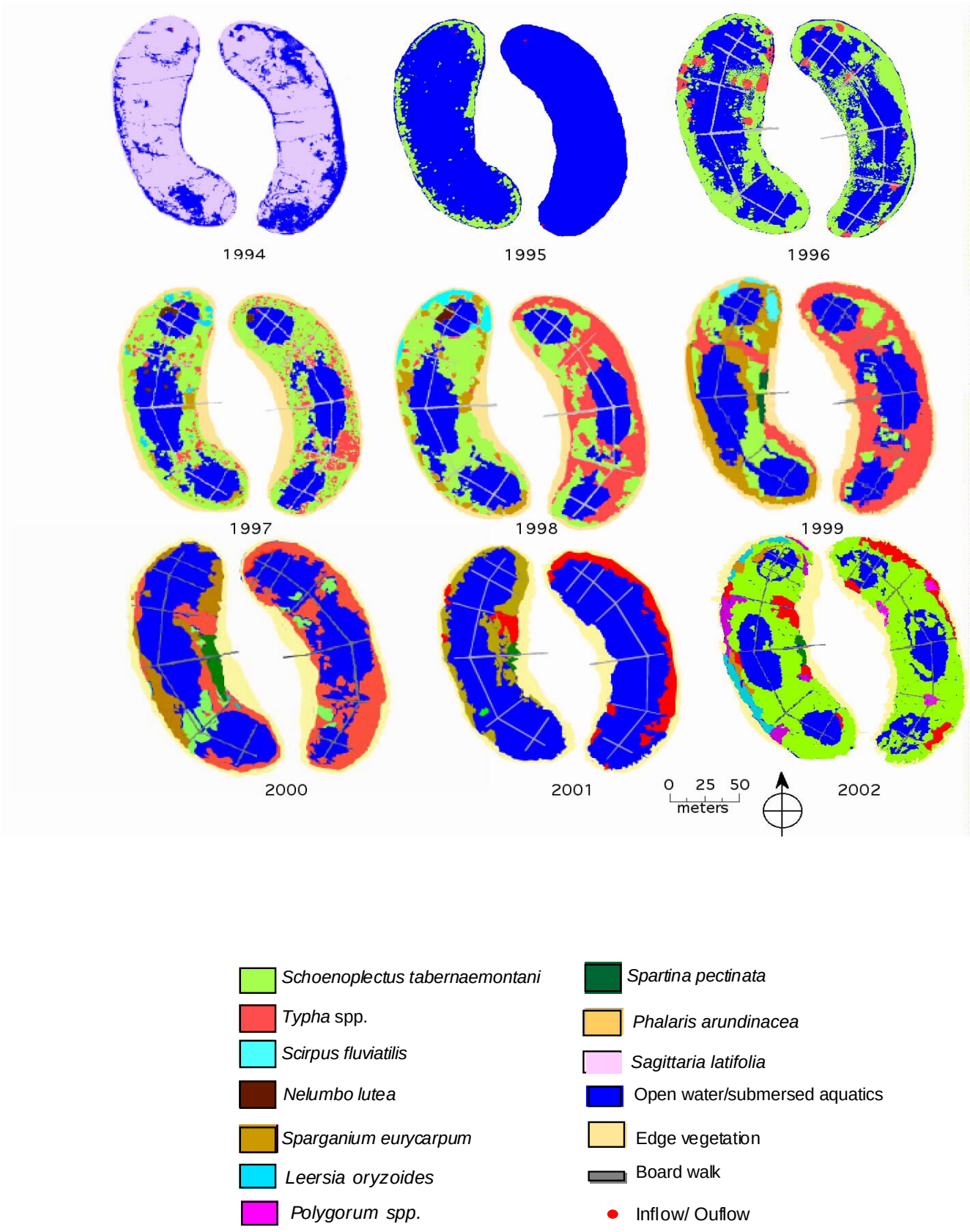

Figure 3. Dominant vegetation community pattern from 1994-2002 in two experimental wetlands.

Table 2. Coverge (m^2) in each basin by each dominant vegetation communities between 1994 -2002.

Zone (m^2) that are dominated by	1994		1995		1996		1997		1998		1999		2000		2001		2002	
	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2	W1	W2
Total basin	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672	8903	8672
Open water	1451	2567	7746	8672	5333	5498	3579	3035	3490	2567	3276	2914	4835	4462	6450	7170	2403	2255
Algal mat	7452	6105																
Schoenoplectus tabernaemontani			1157		3205	3018	4149	4163	3668	2333	1914	876	777	295	26		4630	5463
Typha spp.					365	165	445	1440	98	3772	792	4882	1479	3916	333	1502	445	780
Scirpus fluviatilis							205		392		258		13					
Nelumbo lutea							107	35	89									
Sparganium eurycarpum							418		1166		2261		1407		1930		267	
Sagittaria latifolia							9											
Spartina pectinata											401		375		164		89	
Phalaris arundinacea													18					
Polygonorm spp.																	534	174
Leersia oryzoides																	534	

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Fig. ORW biomass day